

THAT WHICH IS CLAIMED IS:

1. An opto-electronic device, comprising:
a substrate comprising a first III-V semiconductor layer;
an electrically insulating layer that extends on the first III-V semiconductor layer and comprises an array of non-photolithographically defined nanopores therein;
5 an array of vertical quantum-dot superlattices in the array of nanopores; and
a second III-V semiconductor layer on said array of vertical quantum-dot superlattices.
2. The device of Claim 1, wherein the nanopores in the array have an average diameter in a range between about 8nm and about 50 nm.
3. The device of Claim 1, wherein the first III-V semiconductor layer is an N-type semiconductor layer; and wherein the second III-V semiconductor layer is a P-type semiconductor layer.
4. The device of Claim 1, wherein the first III-V semiconductor layer is an N-type $\text{Al}_x\text{Ga}_{1-x}\text{As}$ layer; and wherein the second III-V semiconductor layer is a P-type $\text{Al}_x\text{Ga}_{1-x}\text{As}$ layer.
5. The device of Claim 1, wherein the first III-V semiconductor layer comprises an N-type GaAs layer and an N-type $\text{Al}_x\text{Ga}_{1-x}\text{As}$ layer on the N-type GaAs layer.
6. The device of Claim 5, wherein said electrically insulating layer comprises an anodized aluminum oxide layer having the array of non-photolithographically defined nanopores therein.

7. The device of Claim 6, wherein each of a plurality of vertical quantum-dot superlattices in the array of nanopores comprises an alternating arrangement of InGaAs and GaAs dots therein.

8. The device of Claim 7, wherein said second III-V semiconductor layer comprises a P-type $\text{Al}_x\text{Ga}_{1-x}\text{As}$ layer that contacts said electrically insulating layer and a P-type GaAs layer that extends on the P-type $\text{Al}_x\text{Ga}_{1-x}\text{As}$ layer.

9. The device of Claim 5, wherein said electrically insulating layer comprises a silicon dioxide layer having the array of non-photolithographically defined nanopores therein.

10. The device of Claim 9, wherein each of a plurality of vertical quantum-dot superlattices in the array of nanopores comprises an alternating arrangement of InGaAs and GaAs dots therein.

11. The device of Claim 10, wherein said second III-V semiconductor layer comprises a P-type $\text{Al}_x\text{Ga}_{1-x}\text{As}$ layer that contacts said electrically insulating layer and a P-type GaAs layer that extends on the P-type $\text{Al}_x\text{Ga}_{1-x}\text{As}$ layer.

12. An opto-electronic device, comprising:
an electrically insulating layer having an array of non-photolithographically defined nanopores therein; and
an array of vertical quantum-dot compound semiconductor
5 superlattices in the array of nanopores.

13. The device of Claim 12, wherein said electrically insulating layer comprises an anodized aluminum oxide layer.

14. The device of Claim 12, wherein said electrically insulating layer comprises a silicon dioxide layer.

15. The device of Claim 13, wherein each of a plurality of vertical quantum-dot superlattices in the array of nanopores comprises an alternating arrangement of InGaAs and GaAs dots therein.

16. The device of Claim 12, wherein each of a plurality of vertical quantum-dot superlattices in the array of nanopores comprises an alternating arrangement of InGaAs and GaAs dots therein.